Program: B.Tech in AIML & AIDS   **Academic Year: 2022**   **Duration: 3 hours**

Date: 25.01.2023
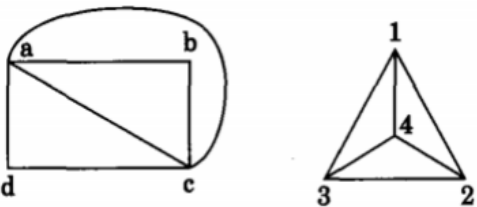**Time: 09:00 am to 12:00 pm**
Subject: Discrete Structures (Semester III)   **Marks: 75**

Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover page of the Answer Book, which is provided for their use.

(1) This question paper contains 04 pages.
(2) All Questions are Compulsory.
(3) All questions carry equal marks.
(4) Answer to each new question is to be started on a fresh page.
(5) Figures in the brackets on the right indicate full marks.
(6) Assume suitable data wherever required, but justify it.
(7) Draw the neat labelled diagrams, wherever necessary.

Question No.		Max. Marks
Q1 (a)	For all sets A, B and C Is $(A \cap B) \cup C = A \cap (B \cup C)$? Justify your statement.	[05]
	OR	[05]
	Consider the truth value $v(p) = F$, $v(q) = T$, $v(r) = T$. Evaluate each preposition's truth value as given below; 1. $(p \rightarrow \neg q) \lor \neg(r \land q)$ 2. $(\neg p \lor \neg q) \rightarrow (p \lor \neg r)$ 3. $\neg(\neg p \rightarrow \neg q) \land r$ 4. $\neg(\neg p \rightarrow q \land \neg r)$	
Q1 (b)	Explain relation and its domain and range? Determine whether each of the following relations are reflexive, symmetric and transitive i) Relation R in the set $A = \{1, 2, 3…13, 14\}$ defined as $R = \{(x, y): 3x - y = 0\}$ ii) Relation R in the set Z of all integers defined as $R = \{(x, y): x - y$ is as integer$\}$	[10]
Q2 (a)	**Solve any two.** A. Determine whether the following graphs are isomorphic. If yes, justify your answer. 	[05]
	B. Determine the sequence whose recurrence relation is $a_n = 2a_{n-1} - a_{n-2}$ with initial condition $a_1 = 1.5$, $a_2 = 3$.	[05]
	C. Convert following sentence in first order predicate logic(using quantifier) i) Mary loves everyone. ii) Everyone loves himself.	[05]

	iii) Everyone loves everyone except himself. iv) Every student who walks talks. v) Every student except George smiles.	
Q2 (b)	Consider A is a fuzzy set which contains A = {(X1, 0.3), $(X_2, 0.7)$, $(X_3, 0.5)$, $(X_4, 0.1)$} and, B is a fuzzy set which contains B = {(X_1, 0.8), $(X_2, 0.2)$, $(X_3, 0.4)$, $(X_4, 0.9)$} then, find A∩B and AUB?	[05]
Q3 (a)	A function f: R –{7/3} → R- {4/3} is defined as : f(x)=(4x-5)/(3x-7) Prove that f is bijective and find the f^{-1}. **OR** Define Function and list out its types? Consider f: {1, 3, 4} → {1, 2, 5} and g: {1, 2, 5} → {1, 3} be given by f = {(1, 2), (3, 5), (4, 1)} and g = {(1, 3), (2, 3), (5, 1)}. Evaluate g_of.	[05] [05]
Q3 (b)	For each binary operation * defined below, determine whether * is commutative or associative. 　(i)　　On Z, define a * b = a − b 　(ii)　　On Q, define a * b = ab + 1	[10]
Q4 (a)	Each student in a class of 40 plays at least one indoor game chess, carrom and scrabble. 18 play chess, 20 play scrabble and 27 play carrom. 7 play chess and scrabble, 12 play scrabble and carrom and 4 play chess, carrom and scrabble. Find the number of students who play (i) chess and carrom. (ii) chess, carrom but not scrabble.	[07]
Q4 (b)	Consider the set A = {4, 5, 6, 7}. Let R be the relation ≤ on A. Draw the directed graph and the Hasse diagram of R. **OR** Given A={1,2,3,4} and a relation R on A given by R= {(4,3), (2,2,),(2,1),(3,1),(1,2)} Show that R is not transitive. Determine the transitive closure of R by Warshall Algorithm	[08] [08]
Q5 (a)	Suppose the relative frequencies are as follows: - A: 40, B: 20, C: 15, D: 50, E:25 draw tree for calculate optimal prefix code? **OR** Items :　　a, e　i　o u　s　t Frequency : 10　15　12　3　4　13　1 Construct the Huffman code for the data given above. What is weight of the minimum weighted path?	[07] [07]

Q5 (b)		[08]

Let $H = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ be parity check matrix.

Determine the group code $e_H : B^3 \rightarrow B^6$

All the Best!